DOCUMENT RESUME

ED 242 059 EA 016 579

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TITLE Computer Applications Planning. A Guide to Planning and Implementing a District-Wide Computer Program.
INSTITUTION Merrimack Education Center, Chelmsford, Mass.
PUB DATE Jan 84
NOTE 102p.; Prepared by The Technology Lighthouse of the Merrimack Education Center.
AVAILABLE FROM Publications, Merrimack Education Center, 101 Mill Road, Chelmsford, MA 01824 ($9.95).
PUB TYPE Guides - Non-Classroom Use (055) -- Reference Materials - General (130) -- Reports - Research/Technical (143)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Change Strategies; *Comprehensive Programs; *Computer Assisted Instruction; Computer Literacy; *Computer Oriented Programs; Computer Software; Curriculum Design; Curriculum Development; Educational Objectives; Educational Technology; Elementary Secondary Education; Inservice Teacher Education; *Long Range Planning; Microcomputers; Program Budgeting; Program Design; Program Development; *Program Implementation; Purchasing; School Districts
IDENTIFIERS Merrimack Education Center MA

ABSTRACT

Designed to help school districts move from exploring the use of computers in the classroom to the comprehensive planning and development of computer education programs, this guide is organized around five steps essential to the process of developing a district program. Phase 1 includes the following preliminary activities involved in planning for technological change: (1) forming a planning committee, (2) establishing broad direction, (3) conducting orientation activities, (4) compiling an inventory of current computer applications, and (5) identifying the planning resources needed. Phase 2, "Integrating Computers into the Curriculum," requires developing broad goal and student competency statements, setting planning priorities, and developing curriculum objectives and instructional strategies and applications. Following phase 3, which involves identifying required and actual faculty competencies and establishing a staff development program, phase 4 is devoted to preparing procurement specifications for software and hardware acquisition. The fifth and last phase involves providing for program coordination and implementation by developing logistical, materials, and equipment support systems. The guide's final section, "Looking Ahead," includes a checklist for each stage of the planning and implementation process. Each of the guide's sections on the five major phases concludes with bibliographical information on supplementary readings. (JBM)

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COMPUTER APPLICATIONS PLANNING

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COMPUTER APPLICATIONS PLANNING

A Guide to Planning and Implementing A District-Wide Computer Program

Prepared by

The Technology Lighthouse

of the

Merrimack Education Center

Chelmsford, Massachusetts

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MERRIMACK EDUCATION CENTER, INC.

The Merrimack Education Center, is an intermediate educational service center for twenty-two school districts in the Merrimack Valley of Massachusetts. The Lighthouse Technology model of the National Diffusion Network, U.S. Education Department, has operated at this site for a full year. This demonstration site was established at MEC in 1983 to assist schools with improving education through the application of technology. MEC has completed over 17 years of service to school districts and is a charter member of the AASA/AAESA organization of regional service agencies. MEC is governed by a Board of Directors that includes superintendents and representatives from business and industry.

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FOREWORD

School districts cannot afford piecemeal approaches to the application of technology. The development and operational costs are too high to allow for fragmented and unsystematic efforts. Few districts, however, have the internal capacity to plan and implement the comprehensive programs that are needed to prepare our young people to use new learning technologies for their education and their careers.

To assist local district staff, the Merrimack Education Center (MEC) has established the Technology Lighthouse, a technology applications support system which provides a comprehensive set of planning and implementation services. The support system has six components, each with several services that may be selected by districts individually or as a total package. The components are:

- Planning
- Hardware
- Courseware
- Training
- Applications
- Implementation Support

Computer Applications Planning is one of the principal resources of the Planning Component. Used in conjunction with the Computer Applications Planning Seminars, this guidebook presents step-by-step procedures for planning and implementing a long-range, comprehensive computer program. It serves as a basic reference tool for local school district staff and as the cornerstone of MEC's technology support system.

Richard Lavin
Executive Director

Merrimack Education Center

ACKNOWLEDGMENTS

The idea for this Guide came from a brief publication entitled Getting Started, developed by the Center for Learning Technologies in the New York State Education Department. That publication is essentially an annotated outline of steps for planning a computer program; this one is intended as a more detailed procedural guide. We have borrowed and extended some of the material from Getting Started, and wish to thank Greg Benson, Director of the Center for Learning Technologies, for permission to do so.

This Guide was written by Charles Mojkowski. George Hanify, Richard Lavin and Jean Sanders made many contributions. We also wish to thank Joan Hamilton, William McKinnon, and Richard Wallace for their helpful reviews of early drafts.

INTRODUCTION

Computers and related interactive learning technologies are powerful tools for revitalizing the curriculum and increasing productivity and effectiveness. No school district can afford to ignore the opportunities and challenges that these innovations present.

If your district is typical, you've already undertaken some staff awareness and training, and initiated a few classroom applications. You should, then, be ready to make the transition from exploration to comprehensive program planning and development. This guide will help you make that transition. It is written for those school district staff who have system-wide responsibility for designing and implementing a computer education program in their school districts.

Computer Applications Planning identifies the essential planning activities and describes the steps you should follow in developing your district's program. This guide is organized according to the five major steps in the process: (1) planning for technological change: preliminary activities; (2) integrating computers into the curriculum; (3) staff development; (4) hardware and software acquisition; and, (5) organization and implementation. It can be used as a stand-alone manual or as part of a staff development program. The guide serves as the principal resource for MEC's Computer Applications Planning Seminars. The seminars are provided to help district staff develop a long-range plan for a comprehensive, K-12 computer program.

Our approach to computer program planning is curriculum driven. We assume that most if not all of the program elements are defined in terms of the curriculum. This approach results in several benefits that have not yet accrued to many computer programs: the focus is on what the

computer can do to help accomplish the existing curriculum more productively; staff training is allocated and phased according to curriculum priorities; and hardware and software acquisition is matched to application needs.

The intended outcome of using this guide is a comprehensive program plan, including a philosophy and mission, statements of expected student competencies, a series of program initiatives in various subject areas, and projections of staff training, hardware and software requirements to implement the initiatives. Resource needs and budget projections are also developed for the long-range plan.

This guide is not devoted solely to providing users with solutions, but is concerned as well with helping practitioners derive their own answers to needs as they perceive them within their districts. More important than learning what to do is the ability to determine why it is to be done.

The serious need for planning should not require that all of a district's current computer applications cease until a plan is developed. Although the pace of implementation might be slowed until some long-range direction is established, existing applications may help the planners to understand needs and possiblities. Many times, isolated innovations can serve as the impetus and model for district-wide programs.

Each section in this guide contains a selection of supplementary readings related to the topics covered in that section. In addition, samples of relevant documents, data collection forms, and related materials are included. The loose-leaf format will accommodate the inclusion of your own materials and worksheets as you move through the process. A selected bibliography is also provided.

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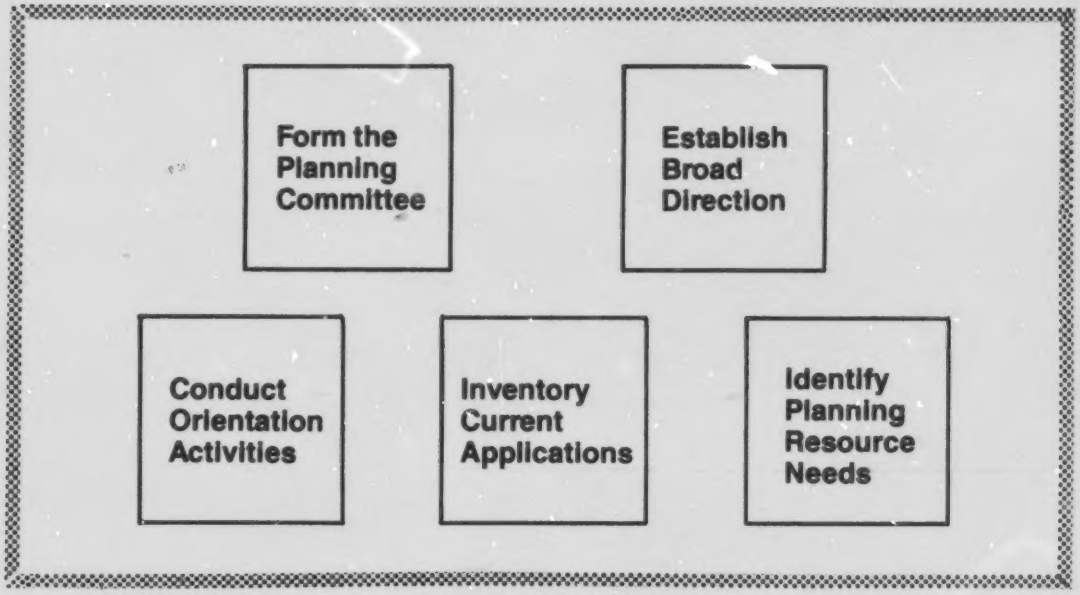
I. PLANNING FOR TECHNOLOGICAL CHANGE: PRELIMINARY ACTIVITIES



Establishing the groundwork for comprehensive planning is nearly as important as the planning itself. This section describes the activities that need to be completed to get ready for planning. We have identified five activities that should be conducted to set the stage for the detailed curriculum development and organizational planning that are required to produce a comprehensive computer program. These activities are:

- Form the planning committee
- Establish broad direction
- Conduct orientation activities
- Inventory current computer applications
- Identify planning resource needs

Although these activities likely will be conducted in the sequence specified, some are repeated at several stages in the overall process. For example, staff orientation and awareness activities for the school committee, parents and other community groups will need to be conducted continually.

Form the Planning Committee

One of the axioms of planning is that it is a people process; implementing change requires that those to be impacted by the changes be involved in planning them. Thus, the principal theme for preliminary planning activities is involvement. There are three groups that will be impacted directly by the program: the staff, students, and the school committee. Those directing the planning effort will need to ensure adequate and appropriate involvement in the planning process by all three groups. Other groups to be involved might be parents and business and community representatives. The district-wide computer program planning committee is the principal means for assuring adequate representation and a stable pool of talent for the work to be done. The computer program planning committee may be staffed in a variety of ways, depending on the size and organization of the district. We suggest the following approach as one that can accommodate, and be adapted to, a wide range of needs.

The planning committee we suggest is composed of a steering committee and a series of subcommittees. The steering committee serves as the decision-making group, responsible for establishing policies and making recommendations for review by the superintendent and the school committee. The subcommittees are responsible for the development of material that goes into the program plan.

The following guidelines may be helpful in forming the planning committee:

1. Include teacher and administrator representatives from all levels (elementary, junior high/middle, and high school) regardless of which levels you will focus on in your initial implementation activities.
2. Include a cross-section of subject area representatives.

3. Include students, parents and community representatives on the committee or on an an advisory group. Solicit nominations from the school committee or from already established groups such as student councils, PTAs, and business/industry councils.

4. Include some sceptics on the committee, or make provisions to secure their input to the planning.

5. Include those with technological expertise, but avoid having the committee be viewed as a collection of computer experts.

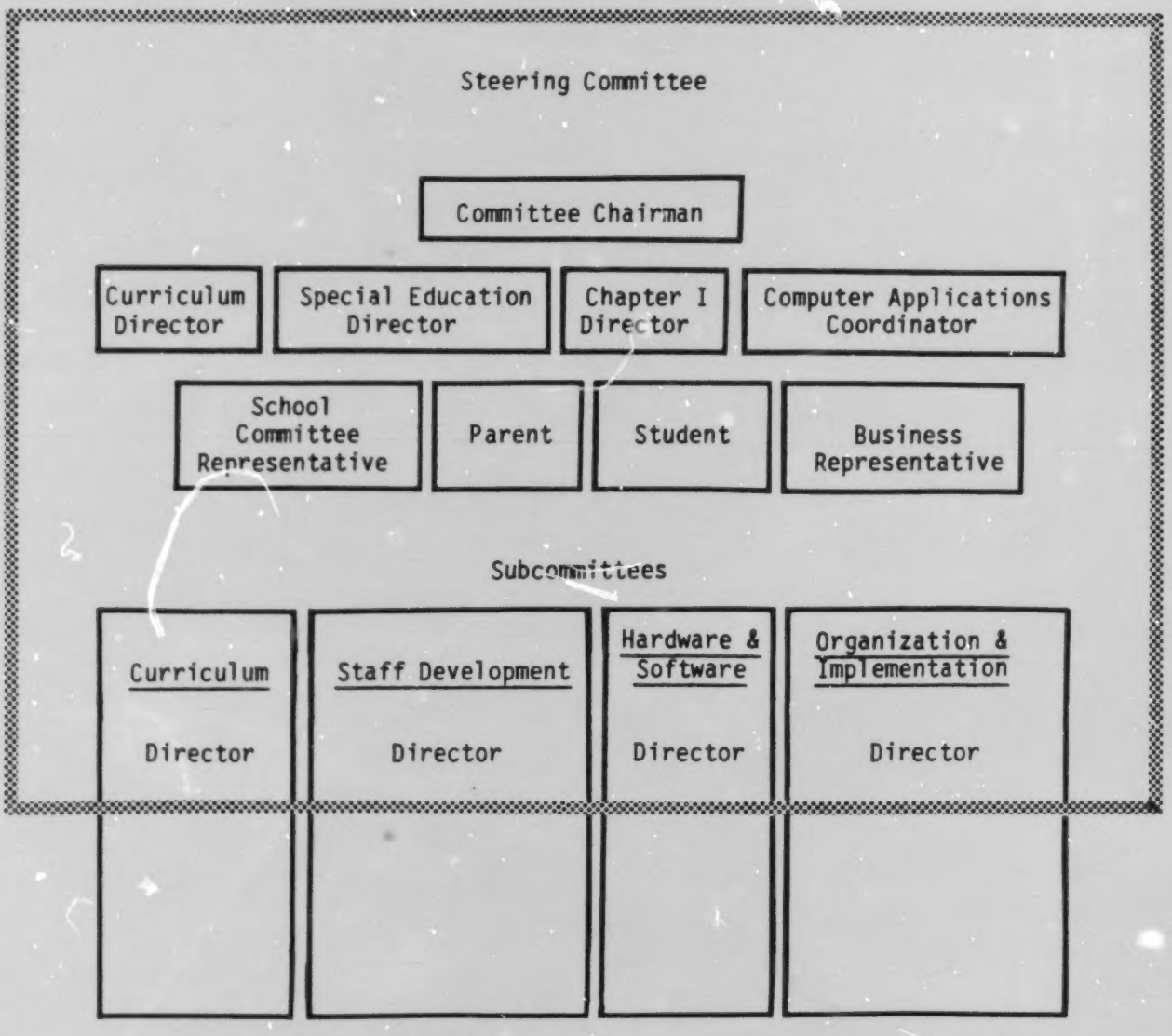
6. Organize subcommittees according to the major task areas: curriculum, staff development, hardware and software, and organization and implementation.

Exhibit I-1 provides an example of a planning committee structure based on these guidelines. In very small districts, the superintendent might appoint a building principal to direct the planning, or he or she might even serve as chairman. In order to represent fully all areas of the school system and to make the best use of personnel resources, the committee can be organized as four functional subcommittees coordinated by a steering committee. The appointment of subcommittee leaders should be based on areas of expertise as well as existing job roles. For example, a building principal may head the staff development subcommittee even though the curriculum director might normally fill that role.

In some districts, a coordinator or director of the computer program may already be appointed. This may be either a full or part-time position depending on the scope of the program and the district's resources. If a coordinator is appointed, that person is a logical choice for the chairmanship of the planning committee. Exhibit I-2 contains a sample position description for that role.

Exhibit I-1

Planning Committee Structure



Usually about 8-12 principals or teachers per subcommittee is sufficient.

Exhibit I-2

Sample Position Description
Computer Program Coordinator

QUALIFICATIONS:

1. A Masters degree from an accredited college or university.

2. At least three year's successful experience in computers relating to teaching and/or administration.

3. Experience in training and/or curriculum development.

4. Familiarity with state-of-the-art technology as it pertains to school applications.

5. Knowledge of appropriate resources, organizations and software resource availability.

6. Knowledge of appropriate resources, organizations and vendors relative to hardware resource availability.

7. Demonstrated success in accomplishing tasks akin to those listed below.

REPORTS TO: Assistant Superintendent of Schools

JOB GOAL: To insure the smooth and efficient operation of all computer applications including hardware, software, training and instruction for the school system. Computer application responsibilities are to be coordinated with the administrative instructional goals of the school system through the office of the Assistant Superintendent of Schools.

PERFORMANCE RESPONSIBILITIES:

1. Assumes overall support for the proper selection and application of computer hardware as it relates to the program needs in the various levels of the school system.

2. Assumes responsibility for networking of hardware capacities within the school system.

Exhibit I-2

Sample Position Description
(continued)

3. Assumes responsibility for the organization of teacher training programs as it relates to the application of computers in the instructional process.

4. Conducts training seminars, workshops and institutes as appropriate to the proper application of hardware and software within the school system.

5. Assists the school system in the development of K-12 computer curriculum.

6. Provides technical assistance to special departments, i.e., business office, special education office, guidance office and the like, in the utilization of technology in administrative and other related areas.

7. Participates in system-wide computer advisory committees that are developing long-range plans for the school system.

8. Responsible for developing staffing plans for the proper support and application of technology at the various levels of the school system.

9. Responsible for developing student user groups and facilitating community usage of computer resources as appropriate.

10. Responsible for development of a system-wide software distribution plan, software exchange and selection system for the utilization of the computer software within the school system.

11. Responsible for updating computer plans and documents on a six-month basis.

TERMS OF EMPLOYMENT: Twelve-month work year.

Although this guide deals almost exclusively with instructional uses of the computer, those districts wishing to plan for administrative applications might form an additional subcommittee to deal with that area. In some cases (e.g., computer managed instruction) administrative applications are extensions of instructional ones. Most often, however, administrative applications are separate activities.

The size of the subcommittees should be matched to the amount of work to be done. Since subcommittee participation is only a minor, part-time responsibility for most faculty, assignments will need to be kept small and manageable within the time constraints. The scope of work for these committees should cover use and study of computers by students and teachers in the classroom and the use of computers to support teachers and administrators in managing instruction.

The superintendent should develop a work statement for the committee which specifies objectives, deliverables and timelines. Exhibit I-3 is an example of such a work statement. The committee chairman should define the roles of each of the subcommittees, and a tentative schedule of meetings should be constructed. Note that the core (steering) committee is composed of the committee chairman, the leaders of the subcommittees, and other representatives (e.g., parents, students, business and community representatives, school committee members). These individuals will need to meet frequently to plan and coordinate the work of the subcommittees.

Exhibit I-3

Superintendent's Charge to the Computer Program Planning Committee

Dear Planning Committee Members:

We have been implementing a variety of computer instruction activities for some time now. I believe we are ready to initiate a comprehensive program. Our current activities have provided us with the experience needed to make the transition to such a program.

I am enclosing a statement of the work that needs to be done, including a tentative outline for the plan itself. The statement is imposing, I know, but anything less will not provide the kind of long-range program that we need. I am confident that we have the talent and experience required to develop the program.

We do not have the luxury of suspending all computer activities while we undertake our planning. If we continue with ad hoc program development, however, we run the risk of wasting limited resources. Therefore, I have promised the school committee a comprehensive plan within four months. It will serve as the basis for our budget allocations during the coming year and provide us with program priorities over a three-year period.

The chairman and the subcommittee leaders should prepare interim progress reports at appropriate intervals. I anticipate a productive effort and a valuable result. Thank you for your commitment to this most important work.

Cordially,

Exhibit I-3 (continued)
Statement of Work

OBJECTIVE: To produce a three-year plan for the implementation of a comprehensive, district-wide computer instruction program.

MAJOR QUESTIONS TO BE ADDRESSED:

1. What will sudents need to know and be able to do?
2. What grade levels and what subject areas will the program address initially?
3. What competencies will teachers and administrators require in order to implement the program? How will they be helped to acquire these competencies?
4. What effects will the computer program have on the existing curriculum?
5. What new materials and equipment will need to be purchased? How will these materials and equipment be distributed, secured, and maintained?
6. How will program priorities be phased in over the three-year period?
7. How much will the program cost? By year? How should it be funded?

EXPECTED DELIVERABLES:

1. A computer curriculum that is fully integrated with the existing curriculum used in the district. The curriculum is to specify a skills scope and sequence, criteria for mastery, required instructional materials, and instructional management procedures.

2. A staff development plan that specifies what teachers will receive what training and related development services. The plan should include timelines and resource requirements.

3. A hardware and software procurement plan which is matched to the curriculum plan. The plan should include recommendations on specific equipment and software, and their costs over the three-year period.

4. An implementation plan which specifies how the program is to be phased in over the three-year period, what faculty and organizational changes will be required, and how the program will be monitored and modified over time to address unforeseen opportunities and problems.

TIMELINE: I will present the report to the school committee in four months. The planning committee should submit a draft report to me within fourteen weeks.

Exhibit I-3 (continued)

Topical Outline for Computer Program Plan

I. Introduction

- A. Purpose of the plan
- B. Background
- C. Planning: process and people

II. Philosophy and Policies

- A. Understandings and assumptions
- B. Key concepts and principles
- C. Policies

III. Program Mission

- A. Goals
- B. Student competencies

IV. Current Program Status

- A. Applications
- B. Staff competencies
- C. Hardware
- D. Software and support materials

V. Overview of Three-Year Plan (1984-1987)

- A. Major program initiatives
- B. Staging and phasing
- C. Resource requirements
- D. Budget

VI. Detailed Yearly Plans (1984-85, 1985-86, 1986-87)

- A. Program initiatives/areas
- B. Curriculum areas addressed
- C. Staff development activities
- D. Equipment requirements (existing and new)
- E. Software and support materials requirements
- F. Operations/implementation activities
- G. Evaluation and follow-up
- H. Costs/resource requirements

VII. Special Considerations

Establish Broad Direction

One of the first tasks of the steering committee (before the first meeting of the entire committee) should be the development of a draft statement of philosophy which sets the direction for the work. Usually such a statement will deal with such issues as: (1) the relationship of computer literacy (broadly defined) to the existing curriculum; (2) general student goals (sometimes referred to as the "mission"), and, (3) how the district will deal with such issues as equity, staff deployment (i.e., reassignments or creation of new roles), program priorities and resource allocation. The sample statement in Exhibit I-4 is an example of such a philosophical and policy pronouncement.

Although the statement of philosophy will likely be modified over time, it is important for providing some general sense of direction for subsequent planning. The statement should be presented to all committee members for review and then presented to the superintendent. Once there is general agreement on the statement, it should be presented to the school committee. Regular and frequent reports to the school committee are important because of the major impact that the completed plan is likely to have on the overall curriculum and on resource allocation (staff, time, facilities, and money).

Statements of philosophy are important in providing faculty, the school committee, parents and the community with "images of potentiality"--a sense of what can be accomplished. Developing such images requires that the planning committee develop a sense of what the world of work and of future schooling will be like for graduates. Based on these images, the philosophy forms the foundation for developing a program mission and a set of strategies for realizing that mission. Be sure that the philosophy statement is shared with all groups and that those who are interested be invited to help develop the program plan.

Exhibit I-4

Statement of Philosophy
For Computer Education Program*

Basic Principles

The introduction of new interactive learning technologies into the curriculum presents us with significant challenges and opportunities. Not only can the computer and related tools help us to deliver instruction more effectively and productively, it can serve as an impetus for revitalizing what we teach. In developing and implementing a computer-based instruction program, we wish to recognize these principles and understandings.

- The most pressing needs for educators continue to be the teaching of the basic skills--reading, communication, and mathematics. Without such skills computer literacy is of limited value.
- Aside from the basic equipment and software utilization skills, computer competencies need to be integrated into the existing curriculum.
- Technology presents us with an opportunity to revitalize the existing curriculum, not merely automate it. In the case of the basic skills, the demands of the emerging (if not already arrived) information economy require that traditional basic skills be augmented with such "new" basics as problem-solving, evaluation, synthesis, analysis, application, decision-making and communication.
- Students, in their further education and in their careers, will need to use the computer as a tool to locate and manipulate information. Therefore, the curriculum must give additional emphasis to procedural knowledge over factual knowledge.
- Students will need to learn how to make appropriate use of the computer as a means for learning new skills and knowledge, and as a device for programming special applications.

*See the supplementary readings at the end of this section for sources of additional philosophy statements.

Program Priorities

Recognizing that our secondary level students will be the first to use computers in their post-secondary education and in their work, our initial program development emphasis will be on this level. Moreover, we shall emphasize using the computer as a tool to do other work rather than as a teaching device. Thus, we will focus initially on such generic computer applications as word processing, spreadsheet development and analysis, and database design and management. Computer-assisted instruction (CAI) will be used only minimally at the secondary grade levels during the next two to three years, primarily because of limited budgets, inadequate software, and insufficient hardware. The emphasis on the secondary grades does not mean that we will ignore the other grade levels. We intend to introduce all students to the computer during the first two to three years. What is an appropriate introduction will be specified in the comprehensive program plan.

Equity

We intend to provide an appropriate computer literacy curriculum for all students in the district, K-12, consistent with sound educational practice. No student will be denied access because of language differences, handicapping conditions, or other exceptionalities. This does not mean that all students will be given equal access; it will be up to the faculty to determine what computer instruction is appropriate for each student within the context of his or her total learning program.

Staff Deployment

The computer program may require the modification of existing roles. It may require that new specialists be hired. Every staff member will need to acquire new competencies. In all of these activities, our aim will be to provide students with the best faculty resources to accomplish the goals of the computer program.

Conduct Orientation Activities

The purpose of orientation activities is to ensure that important groups have appropriate information in order to do their work. There are three groups that need to be provided with some level of orientation: (1) planning committee members; (2) administrators and teachers; and, (3) school committee members, parents, and the community at large. The important consideration here is to adjust the content and format of the orientation to the needs of the group. This orientation should not be confused with the detailed training to be designed as part of the overall plan (see Section III). At this stage, the focus should be on developing awareness and general understanding.

Here's an annotated list of topics that might be covered in the orientation sessions:

Present and Future Educational Applications of Technology. Demonstrations of a variety of applications in instruction, instructional management, and administration. Discussions of trends in hardware and software development and possible implications for future.

Courseware and General Purpose Software. Demonstrations of instructional software in a variety of subject areas and applications. Demonstrations of popular software such as word processing, spreadsheets, and database managers.

Implications of Computers and Related Interactive Learning Technologies for Curriculum, Staff Development and Organization. This is an opportunity to deal generally with some of the questions and anxieties that some faculty are likely to have regarding such issues as whether teachers will be replaced with computers, whether the entire curriculum will need to be redesigned, the scheduling of planning and implementation activities, and ensuring equity of access to computing resources for all students.

A Technical Overview of the Computer. Introduction to the computer's components and how they operate; technical review of software.

Some other considerations for designing orientation sessions are:

1. Be sure that building principals and other key administrators are given early and special attention (e.g., preliminary awareness sessions); they are essential to widespread acceptance and involvement of teachers.
2. Use faculty to conduct orientations whenever possible. It is very likely that there is a good deal of expertise on the staff. Their use builds credibility, lessens resistance, and can save money.
3. Develop multiple ways of providing orientation. Can print materials or videotapes be provided for individual or small-group review?
4. Conduct orientation for planning committee members and teachers and administrators first. Delay conducting orientation activities for other groups (school committee members, parents, community members) until all preliminary activities are completed. Once you have "your act together," you will feel more comfortable about bringing these groups into the planning.

Two additional orientation topics should be addressed with the planning committee. First, they should be made aware of the expected product of the planning effort--a long-range, district-wide program plan. The chairperson should prepare a preliminary outline of the plan and use it as a basis for obtaining consensus about what needs to be done. The outline on page 9 is a sample and should be modified to accommodate the committee's needs and preferences.

A second awareness topic for the committee is managing technological change. Despite our experience with innovation, we often forget or overlook the reactions to a major change effort. When the intimidations of the technology are coupled with the general resistance to changes in the status quo, the potential for failure increases. The committee should be helped to recognize what are likely to be the major barriers to successful program development and implementation, and to formulate strategies for overcoming resistance. Exhibit I-5 is a sample worksheet you might use in designing orientation sessions.

Exhibit I-5

Orientation Planning Worksheet

The following information is suggested for planning orientation activities:

Information	Example
Target Group (specify number, position, subject area)	37 teachers of math, science, social studies, English, music and the arts, grades 7-12
Objectives	Teachers will understand how the computer can be used in applications as a tool in conducting activities related to several subject areas
Topics to be Covered	Word processing, data storage and manipulation, information retrieval, graphics
Activities/Presentation Methods	Demonstrations of various computer tools; limited hands-on use of computers by participants
Equipment/Software Needed	Five microcomputers with large-screen monitors; several generic applications programs
Materials to be Provided	Brief glossary of technical terms, descriptions of typical classroom applications of programs
Media Support	Overhead projector and screen
Time Required	Two hours
Method(s) for Obtaining Feedback	Print survey form; interviews with key informants; discussion session

Inventory Current Computer Applications

In order to develop a comprehensive plan, the committee will need to know what computer applications are being conducted in the district. At a minimum, an inventory and related documentation should be prepared describing the hardware and courseware being used, the types of applications being made, and the level of faculty computer competencies. Exhibits I-6 through I-9 are sample inventory/documentation forms that may be used to collect and organize the required information. Note that, for those districts wishing to plan for administrative applications, an inventory of current uses might also be made at this stage.

This activity might be coordinated by the materials and equipment subcommittee, since the easiest way to conduct such an inventory is to "follow the hardware." This information should be reported to the total committee and updated frequently, because it is unlikely that all the purchasing of hardware and software will stop until the work of the planning committee is completed. Information obtained from the inventory can be prepared as a status report and used as the basis for the long-range plan. The inventory should be viewed as preliminary and cursory. More detailed inventories for hardware, software and staff development are discussed in later sections.

You may want to provide a cover letter with the inventory forms so that respondents will know why you are requesting the information and how specifically you want it reported. A brief paragraph on the purpose of the planning effort would also be helpful.

Exhibit I-6

Documentation of Current Computer Applications

For each application, obtain the following information:

Subject Area:

Grade:

Teacher:

Objectives:

Hardware Required:

Software:

Special Student Population(s):

Exhibit I-7

Inventory of Faculty Computer Competencies*

Determine number and percent of faculty with the following competencies:

_____Can operate computer.

_____Can locate and choose software.

_____Can run software.

_____Can evaluate software.

_____Can develop instructional applications in which computer use is integrated.

_____Knows computer terms.

_____Understands basic computer operations and capabilities.

_____Can use shell programs, utilities and authoring languages.

_____Can write programs.

_____Can develop microcomputer courseware.

_____Can teach programming, data or word processing.

_____ Other: _____

* This list adapted from Computer Literacy Curriculum Guide: Grades K-9, Minnesota School Districts Data Processing Joint Board, September, 1982.

Exhibit I-8

Hardware Inventory Forms

Computers:

Type	Number	School (room)

Computer Peripherals (i.e., printers, modems, disk drives, 80 column boards, plotters, joy sticks, etc.)

Type	Number	School (room)

Exhibit I-9

Courseware/Software Inventory

Instructional Area	Program Name	Type	School (room)

Identify Planning Resources Needed

While people are critical to the success of the planning effort, their effectiveness is determined in large part by the quantity and quality of resources they have to develop the plan. Typically, these resources fall into four categories:

1. Information

   What are the latest trends in technology? What are other school districts doing? What exemplary materials, programs and practices are available for review? What does the latest research have to say?

2. External Experts

   What specialized skills and knowledge will we need to procure? From what source(s)? At what cost?

3. Planning Time

   How much time is required for meetings? For work sessions (individual and small group)? For preparing reports?

4. Materials

   What reports, journals and special publications are needed?

The committee chairman and the subcommittee leaders (the steering committee) should prepare a preliminary list of resource requirements for review by the subcommittee members and for submission to the superintendent. Plans should be made for procuring resources so that they are available at the appropriate stages of the planning process.

Recap

Before moving on to section 2.0, you should have:

- ☐ formed a planning committee;
- ☐ developed a philosophy statement and related policy statements regarding the computer program;
- ☐ initiated orientation sessions for staff and for other key groups, including information for school board;
- ☐ taken an inventory of currently operating computer programs and activities; and
- ☐ identified your planning resource needs.

While some of these activities may continue as other major steps are initiated, it is important that they are at least begun before moving on to curriculum and staff development.

SUPPLEMENTARY READINGS

Section I

Barger, Robert N. "Computer Literacy: Toward a Clearer Definition." THE Journal, Volume II, Number 2, October, 1983.

DeBevoise, Wynn. "Education and Technology: Predicting the Needs of the Future." ERS School Research Forum. Educational Research Service, Inc., 1983.

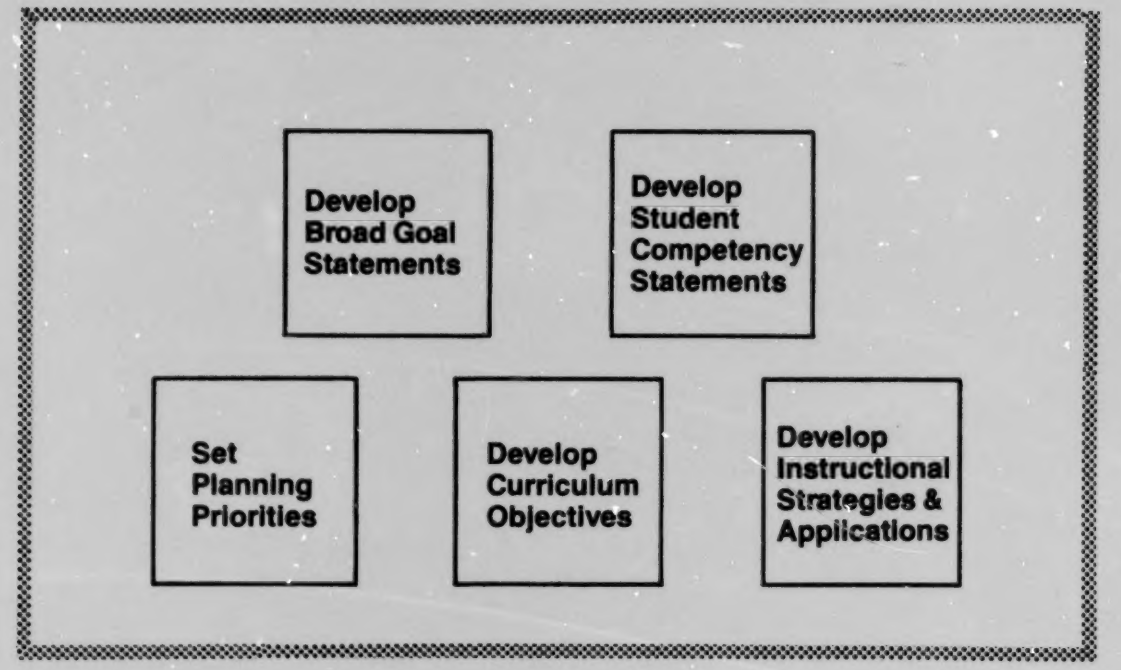
Hopkins Technology Lighthouse. "Technology Position Paper." Hopkins, MN: District #270, 1983.

Peters, G. David and Eddius, John M., A Planning Guide to Successful Computer Instruction. Champaign, IL: Electronic Courseware Systems, Inc., 1981.

Minnesota Department of Education. Planning for Educational Technology. Minneapolis, MN: Minnesota Department of Education, 1983.

Steber, James M. "Developing An Effective Plan for Instructional Computing." THE Journal, Volume 10, Number 6, April, 1983.

II. INTEGRATING COMPUTERS INTO THE CURRICULUM



The primary assumption supporting this guide is that a comprehensive computer curriculum should not be separated from the district-wide curriculum. Keeping them separate will create the impression that computers have little or nothing to do with the existing curriculum and impede the mutual benefits that can accrue to both areas through maximum interaction.

Despite the many technical questions that need to be addressed in planning for the integration of computers into the curriculum, the task is largely an educational one. Indeed, it will be difficult to adequately address many of the technical questions prior to decisions about the educational ones. Avoiding piecemeal tinkering with computers will be best accomplished by a structured approach to curriculum development. Moreover, the availability of computers will provide motivations and opportunities for restructuring and revitalizing the traditional curriculum in many subject areas.

We do not intend this section to be a detailed treatise on curriculum development. There are numerous texts and monographs that provide ample guidance in that regard. Moreover, we recognize that there are several approaches to developing curricula, and that one person's goals are another's broad objectives. For these reasons, we keep our procedures relatively simple.

We propose a five-step process for developing the computer curriculum as a part of the district-wide curriculum:

- Develop broad goal statements
- Develop student competency statements
- Set planning priorities
- Develop curriculum objectives
- Develop instructional strategies and applications

Develop Broad Goal Statements

As with all curriculum, what you do with computers needs to be guided by some general expected outcomes. At the most general level, the principal goal appears to be "computing literacy." Defining computer literacy requires that you specify what you expect students to know and be able to do with computers. This in turn requires that you have some sense of the future environment in which current students will learn and work.

Robert Taylor proposes a set of literacy categories that can be used to establish goal statements. He suggests that a computer can be used in three ways: as a tutor (computer-assisted instruction), as a tool (for example, as a word processor or a graphics device), and as a tutee (i.e., programming or otherwise instructing the computer to perform special operations). Using this set of categories, goal statements might look like the following:

- Students will be able to use the computer as a teaching device to acquire knowledge and develop skills.
- Students will be able to use the computer and available general-purpose software to communicate and compute.
- Students will be able to instruct the computer to perform specific operations.

While these goal statements are sufficiently broad to include most expected outcomes, the curriculum subcommittee may wish to modify the language or include other statements. M. Tim Grady (see supplementary readings at the end of this section) suggests the following goal statements:

- Each student will become aware of the use of computers and information technology in our society.
- Each student will gain knowledge of computer-related terminology.
- Each student will acquire minimum competence in the use of computers and information technology.

The supplementary readings at the end of this section include references to other collections of goal statements. The curriculum subcommittee may wish to conduct a preliminary selection and refinement and then bring them to the total committee for review. As with the philosophy, these goals should then be presented to the school committee. In some cases, the planning committee may wish to obtain review of the goals by all teachers and administrators in the district before seeking school committee approval. (Note that such a review may take considerable time to accomplish.)

Whatever goal statements you devise, they become the organizing framework for the curriculum. More specific student competency statements can then be developed for each of the goals.

Develop Student Competency Statements

The goal statements provide the organizing framework, but more specific statements of student competencies are required to guide the development of the curriculum. Although these statements are more specific, they are not yet linked to the existing subject matter areas. That will be accomplished at the next step in the process.

We use the term competencies to refer to knowledge and attitudes as well as skills. The competencies must specify what students will need to be able to do with computers in continuing their education and in their careers. You can expect some debate about the exact nature of these competencies, since there is not total agreement even among experts about what students should know. There is, however, widespread agreement that students should know how to use the computer to perform basic operations.

What you expect students to do with the computer will dictate the level of "machine literacy" you require. For example, the first of Taylor's modes of computer use--tutor--requires primarily that the student can turn on the machine and "boot," or load, a disk. The second mode or goal area--tool--may require extensive knowledge of the keyboard and a little knowledge of the computer's operating system (in order to set up files, prepare disks for data entry, or transfer and copy data). The last goal--teaching the computer to perform special operations--might require knowledge of memory configurations, compilers, and similar technical components and operations.

Exhibit II-1 provides a selective sample of competency statements that might be developed for a goal. Note that, in addition to the obvious statements dealing with specific skills, students are also expected to know how computers can be misused by individuals to invade privacy or otherwise abuse the private and public rights of individuals and organizations. Communicating using a computer involves knowing what is appropriate communication.

Once the curriculum subcommittee has developed student competencies for each of the goals, they will need to determine the student populations for which they are appropriate. This involves deciding what grade levels and types of students will be addressed. Determining what grade levels are most appropriate for the introduction of specific competencies will require judgments by the committee based on reviews of sample computer curricula as well as the fit within the existing district curriculum. To accomplish this task, the subcommittee may want to seek advice from a sample of teachers and administrators before bringing their work to the full planning committee.

Word processing, for example, may be introduced at the elementary level using appropriate software, but the committee may decide that existing resources (e.g., hardware, software, trained staff) dictate an introduction at grades 8-10 for all students, and gifted students in grades 6 and 7. Subsequent implementation stages may include an expansion of the skill into earlier elementary grades as more teachers are trained and experience is gained.

Exhibit II-1

Sample Goal and Student Competency Statements

Goal

Students will be able to use the computer and appropriate software to communicate and compute.

Competencies

1. Students will understand how computers are used to communicate and perform computations in various occupations.
2. Students will understand what are inappropriate uses of the computer.
3. Students will know the layout of the computer keyboard and the functions of special keys.
4. Students will know how to use the computer's operating system to perform general-purpose operations such as file and disk copying and related file maintenance operations.
5. Students will be able to select and use an appropriate software program for graphing data.
6. Students will be able to select and use an appropriate word processing program for preparing written reports and papers.
7. Students will be able to use the computer to access and search online automated information files.
8. Students will be able to select and use appropriate software for manipulating data for synthesis, analysis and projections.

Set Planning Priorities

With limited time and resources it will not be possible to develop and implement a total curriculum in the first year. Before moving on to the detailed curriculum work, it will be necessary to focus the committee's limited time and energy on a subset of student competencies, grade levels, and subject aeas. The philosophy statement developed previously should provide some guidance on the identification of priorites. (Recall that the sample philosophy statement provided in Exhibit I-4 (page I-12) indicated an initial emphasis on generic applications for secondary school students. Implicit in that statement were criteria for making choices among competency areas, grade levels, and subject areas/applications.)

Exhibit II-2 may be used to determine the initial focus of the planning committee's work. The committee selects priorities based on broad criteria. We suggest the following for consideration; the committee should try to identify others that are important for their planning.

Student need. How critical is the competency to the successful completion of further education or to a career?

Appropriate technology. Are available (in the district or from vendors) hardware and software capable of supporting the application(s)?

Implementation. Can the application(s) be implemented in a reasonable period of time?

Cost. Is the expected cost of the application within the general budget limits of the district? (Be careful at this point not to close off options solely because they may require more than presently available resources.)

Staff Readiness and Commitment. Are faculty in one department ready to move more quickly and with less training required?

Exhibit II-2

Setting Priorities Among Competencies

Competencies	CRITERIA: Student Need	Cost	Staff Readiness	Appropriate Technology	Total
Students will be able to use the LOGO programming language to illustrate basic mathematical concepts and operations. Grade 4	8	7	7	8	30
Students will be able to select and use an appropriate word-processing program for preparing written reports and papers. Grade 9	6	4	4	7	21
Students will be able to use a computer and related peripherals to conduct scientific observations. Grades 7-9.	5	3	2	8	18

Ratings: high = 10, low = 1

The steering committee will need to determine what criteria it will use to set priorities among the competencies. Using the ranking form on page II-39, each competency or competency area (e.g., word processing, communication, data processing) can be listed in the left column, together with the grade level(s) assigned by the committee.

The criteria to be used can be listed across the top of the form. Each competency should then be rated by each member of the committee, using a scale of 1 to 10, with 1 indicating a low implementation priority and 10 indicating high implementation priority. Thus, if a competency statement were addressed to an important student need, the rating might be 8 or 9 on a scale of 1 to 10. If trained staff could not be made available right away, the rating might be 4 or 5.

In some cases, the committee may feel that the criteria are not of equal importance. To accommodate such differences, each criterion can be assigned a weight according to its relative importance; for example, the committee may feel that staff readiness to implement is very important for the first year, and so may give that criterion a higher weight. If you choose to weight the criteria you use, you will need to do so before you use them to rank the competencies.

In Exhibit II-3, the criteria are assigned weights, using a scale of 1 to 5. For example, student need is given a weight of 3, while staff readiness is given a weight of 5 (the relative weights indicating that student need is considered by the committee to be less important during the first year than whether trained teachers are available). Next, each of the competency statements is rated on a ten-point scale for each need, 8 for cost (in this case meaning that the costs are reasonable or acceptable), 7 for staff readiness (indicating that the staff are generally ready to address the competency), and 8 for appropriate technology (indicating that the hardware and software are available to support the application).

Exhibit II-3

Setting Priorities Among Competencies

Competencies	CRITERIA: Student Need weight = 3	Cost 4	Staff Readiness 5	Appropriate Technology 3	Total
Students will be able to use the LOGO programming language to illustrate basic mathematical concepts and operations. Grade 4	8(24)	7(28)	7(35)	8(24)	111
Students will be able to select and use an appropriate word-processing program for preparing written reports and papers. Grade 9	6(18)	4(16)	4(20)	7(21)	75
Students will be able to use a computer and related peripherals to conduct scientific observations. Grades 7-9.	5(15)	3(12)	2(10)	8(24)	61

Weights: high = 5, low = 1

Ratings: high = 10, low = 1

Note: The numbers in ( ) are the products of the rating multiplied by the criterion weight. By totalling across the rows, a ranking can be obtained for each competency. The first competency, with a total of 111, would receive a higher implementation priority than the second, with a total of 75.

For each competency, a mean may be derived from individual forms or in discussion. Thus, priority setting results in a ranked list of student competencies or competency areas. It should not eliminate from future planning items or areas at or near the bottom of the list; it should merely postpone or diminish their development until a later time or until additional resources are available. Thus, a decision to assign a low priority to a competency may mean that it will be given only passing attention until additional resources are available. The estimated level of available resources provides a rough guide to where the line is drawn for future curriculum work. The planning committee can use the ranking as a guide in developing the overall management plan and preparing recommendations for program initiatives.

Setting priorities for program development over the three-to-five year period to be addressed by the plan should not mean that existing activities will be ignored. The committee should examine what applications are already in place and determine how these "pockets of innovation" can be supported and incorporated into the program plan. Often, the efforts of an individual or small group of teachers can form the foundation for a comprehensive program. Building on such a foundation usually can be accomplished more quickly and efficiently, often without the resistance that accompanies totally new programs.

In summary, priority-setting should be structured to allow for a systematic application of criteria to all competencies. Such a process should be complemented and supplemented by professional, sometimes intuitive, judgments about what will work. Knowledge of current practice and of the dynamics of change in the district are essential factors in the decision process. The process of setting priorities will help the committee to identify and deal with such issues as equity, limited resources and needed organizational changes.

Develop Curriculum Objectives

It is with the development of curriculum objectives that the student computer competency statements are interfaced with the existing curriculum. This is accomplished by assigning each competency to one or more subject-matter areas and modifying it to specify the computer application that will be made in that subject area. Thus, the curriculum subcommittee may decide to assign the competencies relating to word processing to the English/Language Arts area. Such an assignment would mean that teachers in that area would have primary responsibility for teaching that competency. How that teaching would be accomplished is left unspecified at this point; that is to be determined through the development of instructional strategies and applications (see Section E, below).

The assignment of word processing to the English/Language Arts area is relatively straightforward. It is possible, however, that some members of the subcommittee may want to have general word processing skills developed in a typing class and leave only subject matter applications to the English/Language Arts department. In some cases, it will be difficult to assign competencies to one specific subject area, and two or more may be selected. For example, competencies related to using graphics programs may be taught in math or art. When multiple areas are involved, the subcommittee will need to see that instructional planning avoids unnecessary duplication and encourages coordination in the development of basic computer-as-tool skills.

The integration of computer competencies into the existing curriculum is a major undertaking and in some cases will require substantial modification of existing objectives and the development of new ones. This integration also provides the motivation for examining

the existing curriculum itself. Adding new competencies may require that existing ones be eliminated or modified. The time for teaching computer competencies must come from the total instructional time available. This pressure on limited time resources can only be relieved by adjusting the existing curriculum.

In addition to the time pressure, the introduction of computer competencies may force a reconceptualization of what is important and necessary to teach. Experts have cited the need to emphasize procedural over factual knowledge, and the need to expand conceptions of basic skills to include higher order analytic and problem-solving skills. While such a reshaping and revitalization of the curriculum may be too large a task to be undertaken by the subcommittee, some attention should be given to areas where further examination and development are needed.

Modifications to the existing curriculum should be expected. If computers are to have their projected impact on our future education, our work and our lives, it would be surprising if they did not have considerable impact on the curriculum.

Exhibit II-4 provides several examples of the transformation of computer competencies into curriculum objectives. Note that in nearly every example, the objective integrates the computer competency with a traditional skill covered in the existing curriculum. In some cases, the availability of the computer will motivate teachers to modify or add new content and skill objectives.

At this point, a key question to be asked by the committee is how much curriculum development work can be included in the long-range plan. The scope and the level of detail of curriculum development activities (i.e., completion of steps D and E) will be dictated by the time and other resources available. The subcommittee may be able to develop curriculum objectives and detailed instructional applications in only one or two subject-matter areas during the first year. The plan itself may contain only one or two complete program units or modules to serve as illustrations for the school committee of what will be accomplished with additional training and time. The program plan may indicate only general curriculum areas to be phased in over the three year period.

Exhibit II-4

Computer Curriculum Objectives

English/Language Arts

Students will be able to use a word processing program to prepare a research report, including footnotes and a bibliography.

Students will be able to use spelling checker software to identify and correct spelling errors in their written work.

Mathematics

Students will be able to use the LOGO programming language to calculate and plot various geometric forms.

Students will be able to use courseware to learn and apply algebraic operations.

Science

Students will be able to use courseware to observe and analyze chemical and physical changes in various substances.

Students will be able to plot data from experiments and develop graphs and other visual representations.

Social Studies

Students will be able to use graphics software to prepare charts and graphs illustrating various characteristics of society.

Students will be able to access online databases (e.g., newspapers, encyclopedias, etc.) to conduct research on selected topics.

Art

Students will be able to use the LOGO programming language to develop and combine the basic forms.

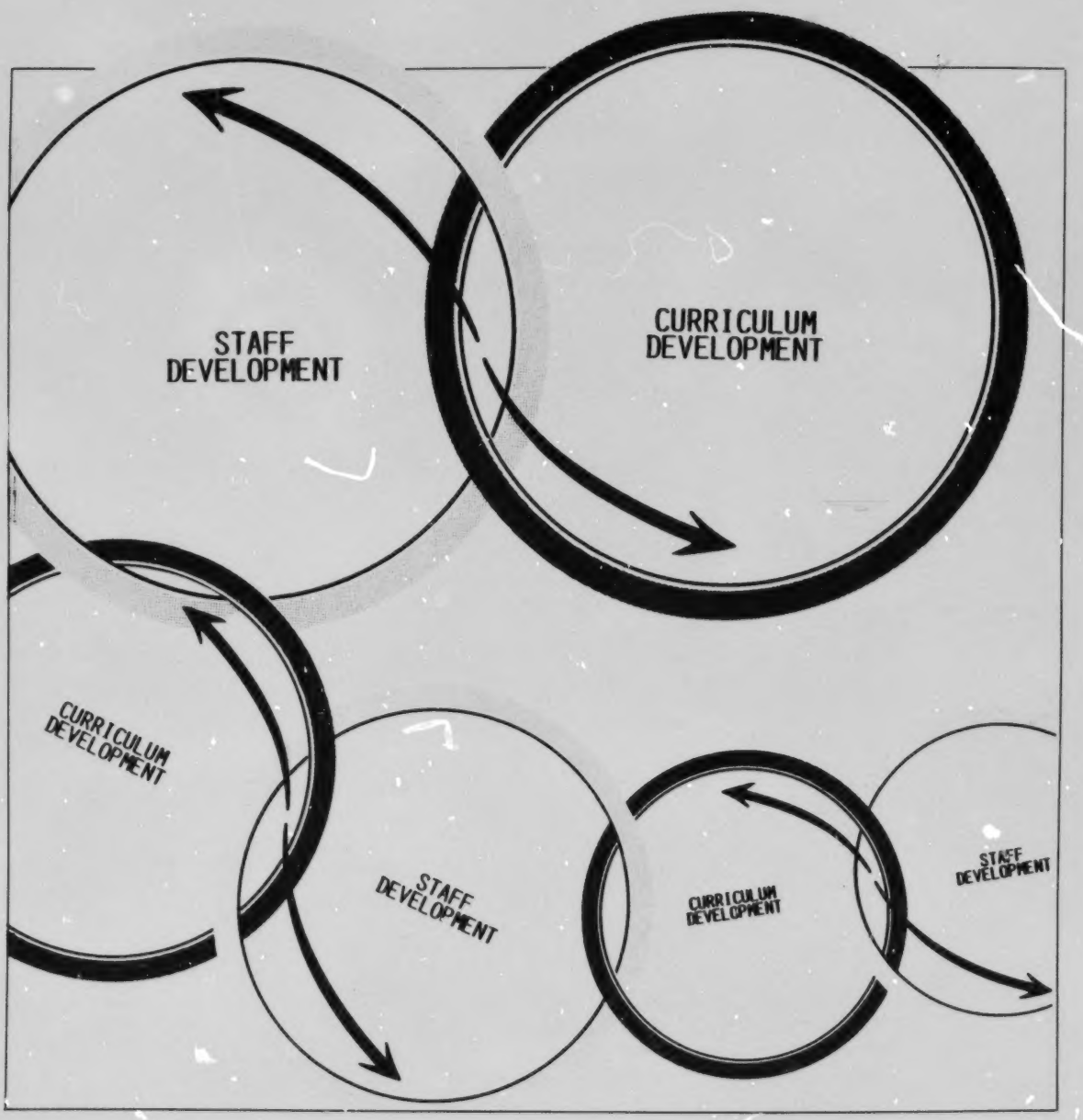
Students will use courseware to learn how to mix colors.

Develop Instructional Strategies and Applications

This step involves the specification of instructional objectives, methods, materials, and performance assessment measures. While it follows naturally from the development of the broader curriculum objectives, this activity should not be undertaken until some staff development has been conducted for the faculty that will be responsible for implementing the instructional plan. This level of curriculum planning must be conducted by the respective subject-matter teachers. The curriculum subcommittee may serve as the coordinating body, but it may need to expand (and perhaps separate) into teams of teachers organized by grade level or subject matter.

Experience indicates that teachers will resist implementing an instructional program that they have not had a hand in developing. Moreover, detailed instructional development should be considered a legitimate and necessary part of the overall staff development program (see Section III). Thus, while the development of instructional strategies and applications is covered in this section, it should be recognized as resulting as well from the outcomes of staff development and of hardware and software selection (Section IV).

Although the overall program planning process we advocate flows in a sequential loop, it is clear that the process does not always move in a forward direction; often it is necessary to loop back to a previous step. Thus, curriculum development both precedes and follows staff development. A broad level of curriculum development is needed in order to train staff; specific curricula cannot be developed without staff training. There are loops within this overall process.



The development of instructional strategies and applications involves the determination of the specific student performance expected, the instructional approaches or methods to be used, the materials and equipment required, and the methods and measures for assessing student performance. Exhibit II-5 provides an example of an instructional objective, together with a description of suggested instructional methods and materials, and assessment measures. For each curriculum objective, there may be several instructional applications.

Exhibit II-5

Instructional Applications

Curriculum Objectives:

1.0 Students will be able to use a word processing program to prepare a research report, including footnotes and a bibliography.

2.0 Students will be able to access online databases.

Instructional Objectives:

1.1 Students will use a word processing program to set margins, tabs, and line spacing, move paragraphs, and edit text.

2.1 Students will use a modem and appropriate communications software to connect with online encyclopedias.

Instructional Methods:

1.2 Demonstration of operations of word processing software; hands-on use by students.

2.2 Demonstration of techniques for searching an online encyclopedia.

Materials/Equipment:

1.3 Word processing software and instruction manuals. Computer lab with no more than three students per computer. A large-screen monitor for whole-class demonstration.

2.3 Modem and communications software. Large-screen monitor for whole-class viewing. Hand-outs describing steps in connecting to database and describing searching techniques.

Evaluation:

1.4 Students will prepare a one-page essay in which margins, tabs and spacing are set as required. Students will be able to demonstrate the ability to move paragraphs.

2.4 Students will access a specific online database and obtain information through appropriate searching techniques.

Although the development of curriculum objectives and instructional applications is a difficult and time-consuming process, resources in this area are proliferating. Teachers engaged in such instructional planning can select curriculum and instructional objectives, and even review entire instructional applications and lesson plans. While teachers will still need to be trained in the development process, the time to "cut and paste" and customize this material for local use will be considerably less than that for development "from scratch." A few resources with such material are cited in the supplementary readings for this section.

Integrating computers into the curriculum is an ongoing task that will require the efforts of all faculty. The planning committee can establish a curriculum framework and begin to fill in the details. The faculty, however, will need to complete the detailed instructional planning, but they will require training before they are ready to undertake the work, as well as considerable ongoing support. Thus, the cycle of curriculum development/staff development/instructional development will likely be repeated at regular intervals throughout the multi-year implementation of the computer program.

Recap

At this point in the process you should have:

- ☐ developed broad goal statements;
- ☐ developed student competency statements;
- ☐ set planning priorities;
- ☐ developed curriculum objectives; and
- ☐ developed instructional strategies and applications.

SUPPLEMENTARY READINGS

Section II

Anderson, Ronald E., and Klassen, Daniel L. "A Conceptual Framework for Developing Computer Literacy Instruction." AEDS Journal, Volume 4, Number 3, Spring, 1981.

Computer Literacy Curriculum Guide: Grades K-9. St Paul: Minnesota School Districts Data Processing Joint Board (TIES), September, 1982. pp. 13-50.

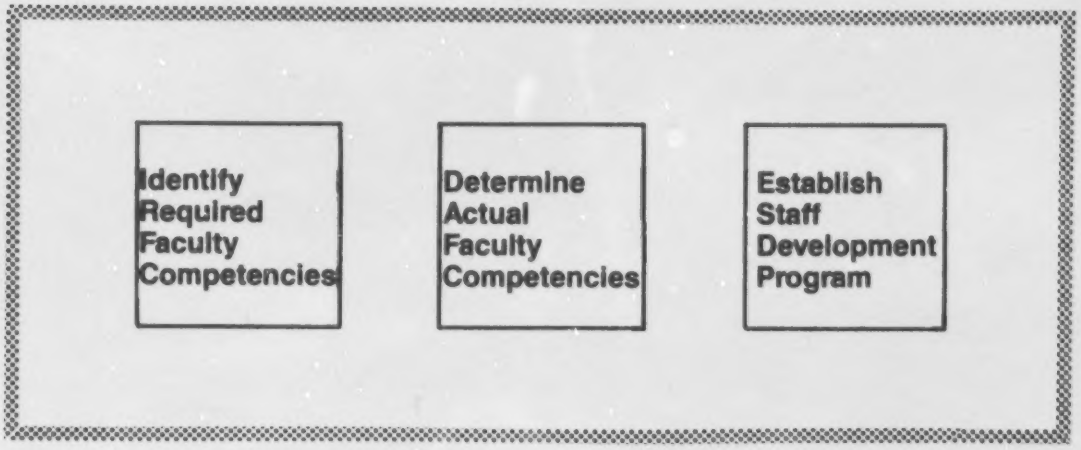
Cupertino, Union School District. "K-8 Computer Literacy Curriculum." Revised 1982. The Computing Teacher, March, 1983, pgs. 7-10.

Grady, M. Tim. "Long-Range Planning for Computer Use". Educational Leadership, May, 1983.

Hunter, Beverly, Dearborn, Donald, and Snyder, Bruce. "Computer Literacy in the K-8 Curriculum." Phi Delta Kappan, October, 1983.

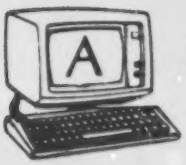
Hunter, Beverly. My Students Use Computers: Learning Activities for Computer Literacy. Reston, Va: Reston Publishing Company, Inc., 1983. See particularly Chapters 3 through 7.

III. STAFF DEVELOPMENT


Identify Required Faculty Competencies
Determine Actual Faculty Competencies
Establish Staff Development Program

Having prepared the curriculum framework and begun the development of instructional strategies and applications, it should be obvious that orientation activities and a basic introductory computer literacy course will be insufficient to prepare teachers to design and implement the computer curriculum. Staff development resources (time as well as dollars) are limited, however, and it will be extremely difficult, if not impossible, to bring all staff to a required proficiency level during the first year or two.

Having set priorities among competencies and curriculum objectives, however, you should be able to identify those teachers who will require immediate training and support. Just as the implementation of the computer program will be phased to accommodate limited time and money, so also can staff development services be delivered over a multi-year period, according to the implementation priorities established for the curriculum. Note that we use the term staff development to include not just training sessions, but the whole range of activities that may be used to help faculty and administrators develop new knowledge, attitudes and skills.



Identify Required Faculty Competencies

Once curriculum priorities are established, it should be relatively easy to identify those faculty competencies required to design and implement instruction. Exhibit III-1 provides a means of organizing the required information. Note that in some instances teachers or principals will require knowledge or skills beyond those they need to impart to students. For example, teachers may need to know how to use a computer networking system in a laboratory setting, or how to use specific functions of the computer operating system. These special requirements should be specified on the form.

Exhibit III-1

Required Faculty Competencies

Student Competency/ Curriculum Objective	Special Requirements	Number of Faculty	Grades	Subject Area
Students will be able to use commercial software to simulate experiments and natural phenomena.	Basic systems operations	12	9	Science
Students will be able to use a computer and peripheral instruments to monitor scientific experiments and collect data.	Use of plug-in boards and measurement probes	10	10-12	Science
Students will be able to use a computer to analyze and plot data from scientific experiments.	Use of graphics software and printers/ plotters.	10	10-12	Science
Students will be able to develop computer programs to perform special functions related to evaluating data and preparation of formulas and models.	Use of PASCAL programming language	5	11-12	Science

Determine Actual Faculty Competencies

Once you have narrowed the target population of teachers and principals requiring staff development services, it will be necessary to determine what skills and knowledge they already have in the specific competency areas. Such a determination is important with respect to computers because some teachers and principals are likely to have advanced skills and knowledge in specific competency areas. It is important to identify this talent pool for use as trainers, facilitators and expert partners in possible teaming situations. Determining staff competencies is equally important in order to avoid putting teachers and principals through training that they do not need.

We do not propose testing or otherwise formally assesssing teacher competencies. Such practices are costly, time-consuming and intimidating. Instead, a self-assessment form might be used to collect the required information. Exhibit III-2 is a sample form used for high school science teachers. Not only does it allow staff to judge their own proficiencies and needs, it communicates to them what specific competencies they will be expected to master. Self-assessments typically involve considerable unmeasurable error, but it is unlikely that teachers will misjudge or misrepresent their abilities in this area, particularly since the competencies are so clearly specified.

Recognizing the critical role of principals and other administrative staff in supporting the instructional process, a determination of their competencies should be made as well. It may not be necessary for the administrators to have detailed knowledge of particular computer operations or software, but their understanding of broader curriculum issues and program organization and implementation requirements is essential to successful operation.

Figure III-2

Computer Competency Inventory

Name_____

School_____ Grade_____

Subject Area_____

The computer curriculum planning committee has proposed that the use of computers as a tool in science be included in the high school science curriculum. Please complete this questionnaire to help us in determining staff development needs.

Complete the inventory by circling the numbers which best describe your competency level and by indicating your desire for training with respect to the computer competencies listed.

Competency	Competency Level					More Training?	
	High		Medium		Low	Yes	No
Can use a computer to run software which simulates various scientific experiments and phenomenon.	5	4	3	2	1		
Can use a computer and related peripheral instruments to monitor scientific experiments and collect data.	5	4	3	2	1		
Can use a computer to analyze and plot data from scientific experiments.	5	4	3	2	1		
Can program a computer to perform special functions related to evaluating data and preparation of formulas and models.	5	4	3	2	1		

Establish Staff Development Program

Having identified required and actual faculty competencies, you can begin to design the staff development program. This will require that you identify those teachers and principals who need or wish to develop or improve their skills and knowledge in each competency. Analysis of the data collected from Exhibit III-2 should provide the required information.

The next step is to organize the competencies (knowledge, skills and attitudes) into groups that can be covered in a training session or in reading materials. Exhibit I-7 on page 19 provides a list of competency areas that may be useful. The Minnesota School District Data Processing Joint Board (see Supplementary Readings) uses a similar list to establish broad competency levels. Exhibit III-3 illustrates how specific competencies may be organized according to those levels.

Based on the organization of competencies that Exhibit III-3 provides, you will be able to prepare a syllabus and agenda for the training sessions at each level. Exhibit III-4 is an example of such a syllabus for a Level I course. This syllabus is used by the Merrimack Education Center.

For each course, you will need to prepare a training module outline (a lesson plan, if you will) that details instructional methods, materials, and activities. Exhibit III-5 provides a framework for preparing such an outline.

Exhibit III-3

Organizing competencies
(An Abbreviated List)

1. Can operate computer

* knows major parts of computer system
* is able to use disk drives and printers
* can use keyboard

2. Can choose software

* knows sources of courseware informati
* can match software to applications

3. Can evaluate software

* can apply selection/evaluation criteria
* can determine relative effectiveness and appropriateness of software

4. Understands basic computer operations and capabilities

* knows the functions of common operating systems
* can perform basic disk/file management operations

5. Can use authoring languages or packages

* can prepare instructional specifications
* can use authoring program to create simple drill and practice routines

6. Can write programs

* is able to use high-level programming languages
* can translate instructional design specifications into computer code

Exhibit III-4

Sample Course Syllabus

COMPUTER LITERACY

Overview: This introductory course is conducted in twelve sessions over three days. It provides an overview of basic information about computers, courseware, and classroom applications, and provides training in using computers for teaching and management. The course is intended for teachers and administrators who have little or no previous knowledge or experience with computers. Typically, a class is composed of educators from one school system, but any group of participants can be accommodated.

Objectives: At the completion of the course, participants will be able to:

1. Identify the distinguishing features of the most popular microcomputers.
2. Select computer hardware (micro and mini) appropriate for particular courseware and classroom applications.
3. Perform basic system operations on at least two computers.
4. Develop and use criteria for the selection and evaluation of courseware.
5. Develop specific applications of computers for classroom use.
6. Design strategies for the implementation of computer-based education.

Exhibit III-4

Sample Course Syllabus
(continued)

Outline of Sessions

Schedule	Topic	Activities
First Day		
Session 1.1	Introduction Intitial computer experiences	Hands-on experience with micro and mini-computer
Session 1.2	Computer competencies: history & training	Lecture & discussion
Session 1.3	Classifying CAI Software	Demonstration and hands-on experience
Second Day		
Session 2.1	Hardware systems	Demonstration
Session 2.2	Software review	Examination of selected commercial courseware
Session 2.3	Classroom applications	Panel and group discussions of successful practices
Third Day		
Session 3.1	Classroom applications	Design of instructional applications by small groups
Session 3.2	Implementation strategies	Group work on strategies

Exhibit III-5

Sample Training Session Module Outline

Specific Competencies (knowledge, skills, attitudes):

1. to understand how to use the Apple II with educational applications
2. to understand how a microcomputer works as a machine so that the user can operate it without assistance
3. to become comfortaable in using a microcomputer in a classroom situation and in talking to others about how it can be used in instruction

Topics:

How a Microcomputer Does Its Work	-- Lecture and Demonstration
Running Programs	-- Hands-on
Care and Handling of Diskettes	-- Lecture and Demonstration
Review of Available Software	-- Hands-on and Discussion

Related Activities (demonstration, lecture, hands-on, materials development, discussion, simulation, etc.):

Hands-on

Equipment:

10 Apple IIE's with single drives and color monitors with necessary extension cords and power strips

Overhead projector

Materials:

Minnesota MECC training materials: Introduction to the Apple II in Instruction (handouts)
Transparencies
MECC Apple Demonstration Disk (with documentation)
Selected Commercial Software
MECC Apple II User Guide

Feedback/Evaluation:

Standard Merrimack Training Evaluation Form

While training sessions are likely to be the most efficient means for providing faculty with new knowledge and skills, there are a variety of strategies and activities that may be used. Consider these:

- reading for self-study
- teaming inexperienced teachers with more experienced colleagues
- observation of exemplary computer applications in other schools or districts
- individual or small-group work sessions for materials or instructional methods development

In addition to designing the training program, the staff development subcommittee will need to lay out a staging and phasing of training activities over the three-to-five year period addressed in the plan. This sequencing will need to parallel the projected implementation of major program initiatives. Knowing what groups of staff will be trained in what competencies during each year will facilitate assigning costs to the staff development component.

Studies of the implementation of new programs and practices attest to the importance of comprehensive and effective staff development. The following guidelines (adapted from Getting Started*) may be helpful in planning your activities.

- Staff development, like the implementation of a comprehensive computer instruction program, is an on-going process, not a one-shot affair. Design a long-range program. Aside from the intrinsic benefits, it will communicate to the faculty that the program is a district priority.

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* New York State Education Department, Center for Learning Technologies, Albany, New York 12230.

- Involve principals in staff development activities. Research and experience testify to the importance of their involvement and leadership in major educational changes.

- We know about how to run effective inservice training. The following principles have been found to enhance computer competency training:

  - The inservice training should prepare the faculty to perform the task and also provide criteria for determining their degree of success.

  - Training activities should be in a sequence that gradually increases in complexity.

  - The training should be sufficiently flexible to allow trainees to begin at their own level of ability and to progress at their own rate.

  - Training should take place during the school day and make use of actual teaching situations involving students.

  - The training should be adjusted to the instructional setting that exists.

  - Incentives should be provided which motivate the faculty to actively participate.

  - Whenever possible, faculty of the district or school should be used as instructors in the training.

  - Teachers should have an opportunity to practice new skills in the course of their regular teaching.

  - Skills acquired in a training program will tend to go unused if not shown to be valued by the administrators of the school.

  - Faculty involved in a training program should have continuous access to an available facilitator--a trained technical resource.

- Expect skepticism and resistance from some faculty members (it's natural) and make provisions for dealing with it openly and directly.

In preparing the staff development plan, it will be necessary to estimate costs over the three-to-five year period. These estimates are important because the amount and cost of training and other staff development activities are often grossly underestimated, particularly for developing skills beyond basic hardware and software competencies. The following considerations may be helpful in preparing cost estimates.

- It may be difficult to establish accurate cost projections, particularly for later years in the long-range plan. A specific and accurate estimate should be prepared at last for the first year.

- Using percentages of the total computer program budget as estimates of training costs is likely to result in inaccuracies, unless they are based on experience.

- If the program initiatives to be implemented each year have been identified (as we recommended), it should be relatively easy to project training costs. The basic steps are:

    1) For each program initiative (major computer curriculum unit or module), determine the number of teachers who will implement the program.

    2) Determine the per unit cost of obtaining the training required and multiply it by the number of staff to be implementing the program unit.

    3) Add cost estimates for any of these expenditure categories that apply: teacher stipends, substitute teachers, materials and facilities.

- There are at least five major ways of procuring training and other staff development services, each with their own costs:

    1) Hardware Vendor -- This training is machine-specific, often largely technical, and costly (per participant fees as high as $250/day).

2) Technical Service Center-- A self-contained facility with hardware, software and trainers, typically located in an intermediate service agency. Fees are ususally considerably lower than those of hardware vendors ($60 to $100 per participant/day).

3) Technical Service Center/On-Site -- The services of the Center are brought on site, using the local district's equipment and facilities. Fees are usually about 25% lower than those for 2.

4) Individual Consultant -- Expert provides ad hoc services using local district's equipment and facilities. Typical fees range from $100 to $300 per day.

5) College -- Formal college course for which participant pays usual fees, which vary considerably across institutions.

Whatever single or combination of training sources are used, you may decide to train only a core of district staff and then use them as trainers for the rest of the faculty. This can result in considerable cost reductions. Care needs to be taken, however, that the trained staff can serve as trainers. Such a role might require special training activities beyond those provided in the basic course.

As we indicated at the end of Section II, staff development and curriculum development are recurring activities, each dependent on the other. While early emphasis may need to be given to helping all staff acquire basic computing knowledge and skills, subsequent stages of training will need to be focused on specific competencies related to the curriculum.

Recap

At the completion of this stage, you should have:

- ☐ identified the competencies teachers and administrators will need in order to address the curriculum;
- ☐ determined what teachers and administrators have what specific knowledge and skills; and
- ☐ established a comprehensive staff development program.

SUPPLEMENTARY READINGS

Section III

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Grady, M. Tim, and Poirot, James L. "Teacher Competence: What is Needed." Computers in Curriculum and Instruction. Alexandria, VA; ASCD, 1982.

Levin, Dan. "Everybody Wants 'Computer Literacy,' So Maybe We Should Know What It Means." The American School Board Journal, May, 1983.

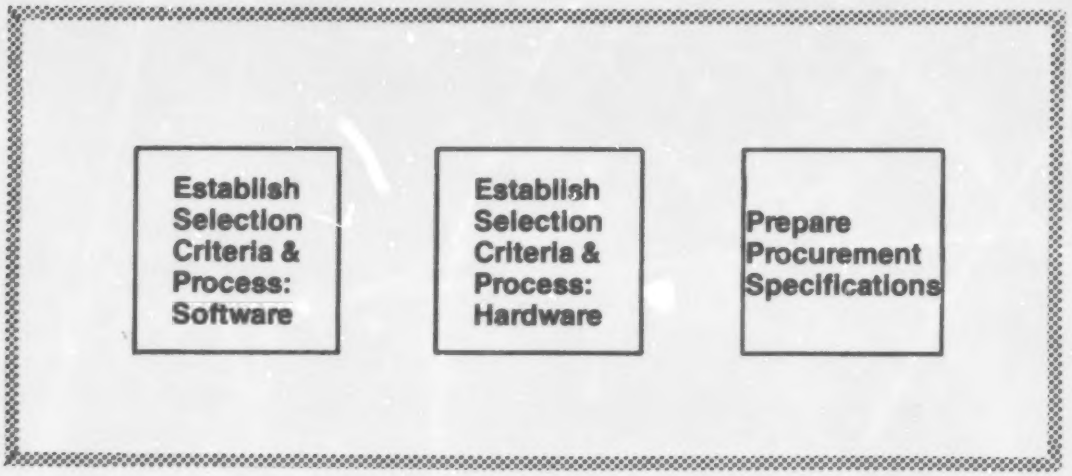
Luehrman, Arthur W. "Should the Computer Teach the Student, or Vice Versa?" Creative Computing, November-December, 1976,

Mathieson, Doris A. "Computers: From Confusion to Collaboration." Educational Leadership. November, 1982.

IV. HARDWARE AND SOFTWARE ACQUISITION

The software and hardware acquisition process is broken down into three steps:

- Establish selection criteria and process: software acquisition
- Establish selection criteria and process: hardware acquisition
- Prepare procurement specifications


Establish Selection Criteria & Process: Software
Establish Selection Criteria & Process: Hardware
Prepare Procurement Specifications

Because most districts already have some software and computers, planning for future acquisitions needs to be based on what is available as well as on what will be needed. The major difference between the process recommended here and that used by most districts in their early implementation efforts is that this one is based on a detailed curriculum plan. Thus, the process of software and hardware selection begins where instructional planning leaves off. Generically, we view the process of software selection as a natural extension of instructional planning: determining what instructional materials will be required to accomplish curriculum goals and objectives.

Establish Selection Criteria and Process: Software Acquistion

We recommend a four-step process for selecting software: identification, description, application and evaluation. Software selection should precede hardware selection because most software is not compatible with all popular microcomputers. While this problem is likely to diminish over time, it is still the case that most high quality software will run on only three or four of the most popular microcomputers. When some hardware is already available in the district, the software choices may be constrained until additional hardware can be purchased.

A district that has purchased inexpensive microcomputers to teach basic literacy skills, may find that their equipment cannot run more complex software. A district can allocate hardware with different capabilities to different purposes, with more limited equipment being used for introductory skills and more powerful computers being used for advanced skills development or instructional applications. By beginning with present and anticipated software needs, this problem can be minimized.

The first step in the software selection process entails the development of a list of software that is related to the instructional applications anticipated. This step is made difficult by the rapidly expanding amount of software available. There are numerous sources of software information. A few references are listed in the Bibliography.

Once a list of software is completed, you will need to prepare a description of it that can be used in an initial screening. Exhibit IV-1 is a sample documentation form that may be used. Most of the information required should be available from the journal reviews or other descriptive material.

Exhibit IV-1

Software Documentation Checklist

1. Software Title_____
2. Version_____
3. Producer_____
4. Cost_____
5. Subject Area_____
6. Specific Topic_____ 7. Grade Level _____

8. Application: ____direct instruction ____instructional management

9. Mode of instruction:
   - ____simulation
   - ____tutorial
   - ____game
   - ____drill and practice
   - ____problem-solving
   - ____demonstration
   - ____other

10. Medium of Transfer:
    - ____5 1/4" disk
    - ____ROM cartridge
    - ____tape cassette
    - ____other
    - ____8" disk

11. Required hardware:
    microcomputer(s)_____
    printer_____
    disk drive/cassette/ROM_____
    joy stick, graphics tablet
    other peripheral equipment_____

12. Required software/operating system:_____
    _____

13. Average time for student to complete the program:_____
14. Has the program been evaluated? ____yes ____no
    If yes, where (cite source)?_____
15. Can the software be previewed? ____yes ____no
    (Many publishers have a thirty-day preview policy.)

It may be necessary to actually run the software in order to respond to some of the items (e.g., items 7 and 9). As the software collection grows over time, this descriptive information can be organized into a computerized file for cataloging and easy selection.

Once you have obtained basic documentation on the software, you will need to determine its appropriateness for the instructional objectives you have established. Typically, these questions are included as part of the evaluation, but they are not actual judgments of the quality of the software. Instead, they are judgments you need to make about the appropriateness of the software for a particular instructional application, regardless of its technical quality. For our purposes, we can call this set of questions application criteria.

Completing the Instructional Applications Checklist (Exhibit IV-2) is the second step in the process of selecting software for classroom use. This is the form that will be most useful to the classroom teacher in the selection process. It focuses on how the software will fit into the ongoing instructional applications employed in the classroom. Having narrowed the pool of software using the Documentation and Applications forms, you should be ready to make some judgments about quality.

As with documentation, the number of evaluation criteria and forms has multiplied as rapidly as the interest of teachers and administrators in computer-based teaching. We have developed a composite of the evaluation criteria employed by several organizations engaged in software evaluation. How many of these criteria you actually use is a function of such factors as the time and resources you have available for assessment, the cost of the software, and the scope of its use (e.g., one classroom or districtwide).

Exhibit IV-2

Applications Checklist

	Yes	No
1. Is the software targeted toward priority student competencies?	___	___
2. Are the software objectives compatible with those of the overall curriculum?	___	___
3. Is the software compatible with the other instructional materials to be used?	___	___
4. Do the objectives include the level of skills (i.e., knowledge, comprehension, application, analysis, syntnesis) you wish to address?	___	___
5. Is the function of the software (i.e., mainline or supplementary instruction) compatible with how you wish to use it?	___	___
6. Can the objectives of the software be addressed more efficiently using traditional instructional materials?	___	___
7. Can you carry out the teacher role that the software requires?	___	___
8. Can the software accommodate the instructional grouping (i.e., individual, small group, large group) you wish to use?	___	___
9. Is the readability level of the text appropriate for the intended students?	___	___
10. Can the software be adapted to include different content or responses?	___	___

Exhibit IV-3 contains a list of evaluation criteria that can be used to accomplish the final step in the software selection process. The criteria are presented as a series of questions that you will need to answer with respect to the software. While some may be answered with a yes-no response, most will require some form of rating sale.

Keep in mind that software, along with the supporting print materials for teachers and students, is essentially a form of instructional material, and that the basic principles used in evaluating textbooks and other print and nonprint materials apply equally to software. It may be necessary to review curriculum standards and guidelines published by professional associations or state education agencies.

Negative or poor ratings on any one or two of the criteria should not necessarily require a rejection of the software package. Given the state-of-the-art of software development, it is unlikely that most of the software presently available will be able to meet all or most of the criteria listed. Judgments will need to be made on whether the inadequacies of the package can be overcome by modifying the software (if possible) or through other means of instruction.

It is unlikely that teachers will have sufficient time to use these criteria and procedures to evaluate and select all of the software that they will use, although a district-wide committee may. It is more likely that much of the technical screening of software according to criteria such as that found in Exhibit IV.2 will be accomplished through reviews of formal evaluations conducted by special-purpose organizations. (See the list of references in the Bibliography).

Finally, it will not be possible to specify in the program plan all of the software that will be purchased. The curriculum, including the specification of instructional applications, will need to be completed before software purchases can be made. The plan should include a brief description of the selection process and some rough estimates of the kind and cost of software needed to support the implementation of the first major program initiatives.

Exhibit IV-3

Software Evaluation Criteria

General

1. Is this an effective use of the computer?
2. Is the purpose of the program well-defined?
3. Are objectives stated in terms of learner performance?
4. Is the range and scope of content adequate to achieve program's intent?
5. Is the program technically sound, free of programming errors, easy to operate?
6. Does the program provide a useful summary or report of student performance?
7. Is the program free of excessive competition and violence?
8. Is the program free of racial, sex, and ethnic stereotypes?
9. Is the documentation sufficient?

Instructional Design

1. Is the content factually correct?
2. Is the presentation logical and well-organized?
3. Are the interest level, difficulty level and vocabulary level compatible?
4. Can the instructor modify the program?
5. Are graphics and sound used appropriately to enhance instruction?
6. Are instructions clear, complete and concise?
7. Can the user skip them and return to them (HELP) as needed?
8. Is the user told how to end the program, start over or re-enter where the user left off?

Exhibit IV-3

Software Evaluation Criteria
(continued)

9. Can students operate the program easily and independently?

10. Are user support materials provided (i.e., worksheet, etc.)?

Program Design

1. Is the instructional text formatted for screen display?

2. Is the amount of text appropriate?

3. Does the software use the special capabilities of the computer?

4. Is the sequencing of content adaptable according to teacher or student preferences?

5. Is feedback to the student provided?

6. Can the student control the program?

7. Are exercises randomly generated?

8. Is the program "crash-proof" (i.e., is it impossible for a student to halt the operation of the program by hitting the wrong key or responding incorrectly)?

9. Is the response time acceptable?

10. Is the program loading time acceptable?

Establish Selection Criteria and Process: Hardware Acquisition

Once appropriate software is selected for each instructional application, compatible computer hardware should be chosen. Tinker suggests a five-step process.* For each instructional application:

1. Estimate how much time a student will need on the computer in order to accomplish the objectives.

2. Determine how many students can use the computer simultaneously (i.e., can students work in teams of two or three to a machine?)

3. Determine what computer capabilities are required to run the courseware you intend to use; for example: memory size, type of data storage, color.

4. Identify the available hardware systems that have those capabilities.

5. Rate each system on such criteria as:

   a) the range of software it will run
   b) its frequency of repair record
   c) available service and technical support
   d) potential for multiple uses
   e) potential for expansion
   f) ease of use
   g) the range of high-level languages (e.g., BASIC, Pascal) it will run.

To Tinker's list we add the following recommendations:

1. Define the intended application specifically (e.g., "The computer system is to utilize software providing color, sound, and visual response in mathematics and language arts drill and practice.").

2. Define who the users will be (e.g., "The computer system will be utilized, under the supervision of the classroom instructor, by third through fifth graders at the Montgomery School.").

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* Tinker, Robert. "A Decision Model for Microcomputer Applications," In Microcomputers in Education: An Introduction. Chelmsford, MA: Northeast Regional Exchange, 1982, pp. 45-49.

3. State where the computers will be used (e.g., "The computer system will be secured to a mobile cart and transported to each classroom in which it is to be used.").

4. Indicate when the computers will be used (e.g., "The computers will be used in the school media center throughout the school day and for one-half hour before and after school.").

5. Indicate why the computer will be used (e.g., "This system is provided to the classroom instructors as a tool to help reinforce basic mathematics and language skills, as learned in the class, as well as, provide a hands-on experience for the students with technological products they will have to deal with as adults.").

Some of the features of computer systems that can be used as criteria in the selection process are:

Processor — The type of CPU "chip" can make a difference in your decision. Chips on which "standard" operating systems, such as CP/M, can be run, provide more flexibility and future compatibility. Popular CPU's include the 8080, Z-80, and 8086, all capable of running CP/M. Another popular chip is the 6502, which is used in several computer systems.

Internal Memory — The maximum amount of memory in the form of RAM, or Random Access Memory, determines the level of sophistication of the software and usability to the student. Most software products provide the minimum amount of memory required (Measured in Kilobytes, or Kb.). Typical memory sizes range from 16Kb to 64Kb.

Mass Storage — The capacity of mass storage devices, such as floppy disks, determine the number of disk drives required and the total cost of the system. Also measured in Kilobytes (Kb. or K), typical 5 1/4" drives range between 125K to 450K of storage.

Editing Keys — A consideration where the software application involves working with data on the screen. This feature varies widely, ranging from none on one of the most popular computers to full cursor control (all four directions) plus insert, delete, and screen editing capabilities.

Numeric Keypad	Important where numbers will be in constant use (math drill & practice, financial applications, etc.), this is an additional keyboard, usually attached to the main keyboard and arranged in a calculator format.
Touch	Totally subjective, this is the feel of the keyboard. The IBM Selectric typewriter is the most widely accepted standard.
Display Width	A consideration in computer literacy applications involving business (accounting, word processing, etc.). The standard display width for 8-1/2 by 11" paper is 80 columns.
Appearance	Too often downplayed, many of the microcomputers available are unattractive and tiring to work on, and the working environment suffers for it.
Price	Not the most important factor, but of great significance. When balanced against available features some of the contenders for purchase will be dropped for lack of competitive value.

There are many more specific criteria that can be employed to select hardware. The Supplementary Readings contain information on other sources. In most cases, selecting hardware involves considerable compromise, since any one computer model is not likely to have all of the features you desire at the price you can afford to pay.

It is unlikely that a district will have only one model of computers throughout the district; certainly over time this will not be the case. It will be necessary to match hardware to the variety of applications that will be operating. Total standardization may not be desirable even if achievable. Students should be exposed to a range of equipment as they work on different applications; their future schooling and work will require that they be able to adapt to new and different equipment.

In addition to focusing on the hardware and its applications, you should also examine the vendors themselves. The following items are worth consideration:

Training & Support	Does the supplier have any full-time training and support specialists? Do they have facilities to train in-house, or at their offices? Are they going to charge for the training? If so, how much? If not, how much will they provide for free? And after the free training is over, how much will they charge?
Service & Repair	A quality dealer will provide depot service for all of the products that they will sell. Find out how many full time service employees they have. Ask to inspect their service facilities. Are they well organized? Are they willing to show what they are working on now? How long has it been since they received the repaired items? Will they guarantee turn-around time for repairs? Will they provide loaner equipment for repairs? Who has to pick up and deliver the repairs?
Reputation	How long have they been in business? How long have they sold computers? What did they sell before they had microcomputers? Get referrals from other school systems! What size is their company?*

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* For additional information, see Fail/Safe Manual for selection criteria. Chelmsford, Massachusetts: Merrimack Education Center, 1982.

Prepare Procurement Specifications

Once the selection process is completed, it will be necessary to translate the results into procurement specifications. In most cases, bid specs will not be required for software: you will be able to order exactly the software you determined to be most appropriate. With hardware, you may not be able to (or not want to) specify a particular brand, but will be required to order general capabilities. Many educational collaboratives and other organizations offer assistance in preparing bid specifications and in procuring hardware at discounted prices.

Projecting hardware costs, at least for the first year, should be based on the instructional applications to be initiated. Following the steps suggested on page IV-69, will result in an accurate estimate of the number of computers to be needed. Projecting other related costs may be more difficult. If you cannot calculate the cost of software and peripheral equipment, the following prcentage estimates may be helpful:*

Item	% of Total Budget
Equipment (basic unit)	66%
Hardware peripherals	12%
Software	12%
Maintenance	5%
Miscellaneous	5%

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* Neill, Shirley Boes. "Tips for Principals." Reston, VA: National Association of Secondary School Principals, November, 1983.

Note also that, over time, the percentage of the budget allocated to software will rise, while that for hardware will diminish.

Other factors to be considered in estimated costs are:

1. Leasing--the burden of large up-front costs for computers may be reduced establishing a lease-purchase arrangement for equipment.

2. Hardware--Experts estimate that the costs of a given amount of computer capability is diminishing by 20 to 30% per year. Projections need to reflect this fact.

3. Obsolescence--While the "wear life" of most hardware will be about five to seven years, some may be relatively less useful than new hardware for a specific application within three to four years. Equipment that is no longer useful for one application may be assigned to another, less demanding one.

Recap

At the completion of this stage, you should have:

- ☐ established criteria and procedures for evaluating and selecting software and hardware; and
- ☐ prepared specifications for procuring appropriate software and hardware.

SUPPLEMENTARY READINGS

Section IV

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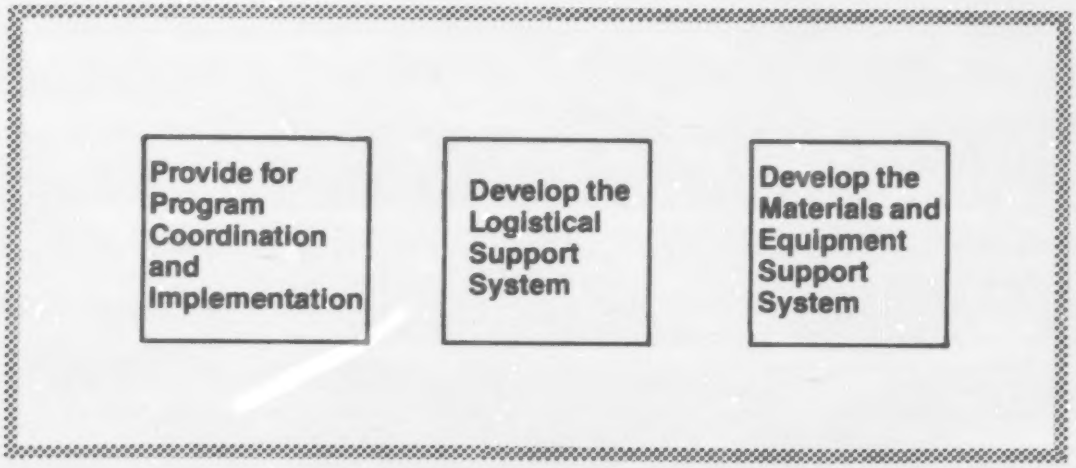
V. ORGANIZATION AND IMPLEMENTATION

Recent research and experience testify to the importance of program implementation. It does not necessarily follow that a well-defined curriculum, a trained staff, and adequate materials and equipment will result in the implementation of a program as planned. Considerable attention to the actual delivery of services is required. Several issues need to be addressed. For example:

- Who will provide ongoing advice and assistance to faculty?
- How will the implementation be monitored? By whom?
- How will access to computers and courseware be allocated and scheduled?
- How will equipment be maintained, secured, and insured?
- What evaluation data will be collected?

A district-wide program that is developing over a three-to-five year planning period is a different undertaking than a collection of individual activities. Such a program requires detailed attention to organization and implementation. This section describes the three major tasks that need to be undertaken:


Provide for Program Coordination and Implementation
Develop the Logistical Support System
Develop the Materials and Equipment Support System

Provide for Program Coordination and Implementation

While the planning committee serves as the principal means of coordinating program development, a committee is not the most efficient means for coordinating implementation. Ideally, one individual should be designated as the implementation director, responsible for overall program management. Many districts will find it difficult to allocate a full-time position to this role. In such cases, an existing administrator or teacher-manager should be given such responsibility as a part-time responsibility.

Given the strong curriculum emphasis we advocate, we recommend that the coordinator have a balanced expertise--a blending of technology with sound pedagogy. Appointing a computer specialist who is inexperienced in curriculum development and implementation may communicate to the faculty that technology is separate from, and more important than, the ongoing curriculum. The sample position description on page 11 calls for a balanced capability.

The principal responsibility of the computer program coordinator is managing the implementation of the plan developed by the committee. Consistent with the five major steps in the process, the plan should be similar to the one outlined in the Superintendent's Statement of Work (Section I, P. I-12). Putting all of the elements of the plan into operation will require detailed specification of activities and their sequencing. Some form of an activities timeline may be needed. Activities scheduling methods can range from simple to complex; some project management systems require the use of a computer for development and maintenance. Exhibits V-1 and V-2 are examples of simple implementation schedules that show the staging and phasing of key activities over the three year period. These forms are good for presentations to the school committee because they describe broad program directions.

Exhibit V-1

STAGING AND PHASING OF
COMPUTER APPLICATIONS

STUDENT COMPETENCIES AND SUBJECT AREAS

Grade Levels	1984-85	1985-86	1986-87
K-3			
4-6			
7-9			
10-12			

Exhibit V-2

STAGING AND PHASING OF
STAFF DEVELOPMENT ACTIVITIES

TARGET GROUPS

	1984-85	1985-86	1986-87
Level I Training			
Level II Training			
Level III Training			

Implementing the plan requires attention to many factors which research and experience have shown to be critical to successful change efforts in schools. Consider these guidelines in putting your plans into effect.

- Keep faculty informed of program implementation activities throughout the school and district.
- Schedule meetings where the faculty can discuss implementation difficulties with their colleagues and share ideas for dealing with them. Use these sessions to be sure that everyone has a clear understanding of the program.
- Encourage and support the principal in the role of a facilitator and resource person to the faculty.
- Provide teachers with sufficient time to prepare or adapt instructional materials for their own use. They may need time to practice using the courseware on the computer.
- Pay attention to what is actually happening in classrooms. Insure that actual implementation is going according to plans. If not, find out why.
- Document implementation activities. What problems were encountered? How were they solved?
- Provide encouragement and support from the central office staff.

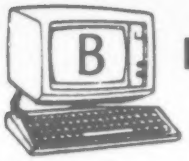
A few of these guidelines merit additional attention here.

Training. As we indicated in Section III, training is not a one-time effort, but an ongoing process with an agenda dictated in large part by information obtained from monitoring the implementation of the program. The planning committee needs to communicate clearly to the superintendent and the school committee that successful implementation and expected student performance outcomes cannot be realized without ongoing and responsive staff development.

The Principal's Role. The opportunities for a substantive leadership role are many. The principal should have sufficient technical knowledge to assist staff or to decide what technical assistance is needed. He/she should take an active role in the development and implementation of the curriculum, and serve as a consultant to the teachers in the integration of the computer into the existing curriculum. Most important, the principal should monitor program implementation, noting problems and unanticipated outcomes, and providing staff with the "hand-holding" that is essential to the successful implementation of such a complex innovation.

Program Evaluation. There are essentially two types of evaluation information that need to be collected in order to "fine-tune" the computer program and make judgments on its effectiveness. First, the implementation needs to be monitored to determine if it is proceeding as planned. This can be accomplished through checklists, observations, and discussions with teachers. Experience indicates that implementation falters when teachers are not clear about what specific activities are required to implement a program. A simple checklist of indicators may serve as a guide for teachers on what is expected. The checklist may also serve as a self-administered instrument to enable teachers to identify implementation problems that need to be addressed through additional training sessions.

The second type of evaluation deals with the impact of the program on student performance. Can the students operate the equipment? Can they write an error-free program? Have their writing skills improved as a result of using the computer as a word processor? Most of these performance questions will need to be addressed by customized tests and instruments because commercial instruments are not widely available.



Develop Logistical Support System

The logistical support system deals with the allocation of hardware and software across the applications specified in the computer program plan. Because the number of computers will be less than the number of applications, it will be necessary to use a distribution and scheduling system for each school building, and in some cases throughout the district. Most computers should be housed in a central location in a school and checked out as any other piece of valuable equipment. An exception to this recommendation is the self-contained computer lab, where students can be sent to learn basic computer literacy skills or to use the computers to do assigned work in a subject area.

The logistical plan should specify what equipment will be used and by whom. In many cases, this plan can be managed by a teacher. As the courseware collection grows, it also could be managed centrally and distributed to teachers as it is needed. The expense of a comprehensive courseware collection may require a district-wide distribution system. Exhibit V-3 is an example of a school distribution plan.

Exhibit V-3

Hardware and Software Distribution Plan

Period	Teacher	Application	Equipment (#)	Courseware
1	Benson	Word processing	Apple //e (2)	Bank Street Writer
1	Marks	Scientific measurement	Timex (6) w/ interface boards	Measuring & Plotting
2	Jones	Graphing population shifts	Commodore (4)	Graphics
3	Harris	Searching online databases	Apple //e (1) w/modem	Micro-Courier

The location of the computers will effect how students and teachers use them. A computer lab may indicate to students that the computers are a separate course of study, unrelated to their traditional subjects. Attention needs to be given to encouraging teachers to assign students to use the computer lab to complete subject matter assignments (e.g., using a word processor to prepare a report; using a graphics program to prepare charts; using a tutorial program to practice vocabulary in a foreign language). The link between the computers in the classroom and those in the lab must be strengthened in order to realize the integration of computers into the total curriculum. To support this objective logistically, a scheduling system may need to be developed to assign students to a lab.

The important concept here is that the placement of equipment should match the instructional application. For example:

- Teacher-directed demonstrations, individualized tutorials, and ad hoc student uses may require only a single computer in a classroom.
- Word processing, programming instruction, and CAI lessons, may require at least one computer for every two students. Such a requirement might be met with a dedicated lab of computers or several computers in a classroom.

Develop Materials and Equipment Support System

Experience with computers and courseware in schools indicates that they are highly susceptible to damage and theft. The purpose of the materials and equipment support system is to assure that adequately operating hardware and software are available as needed to support the program. There are four principal tasks that need to be accomplished through this system:

Security. All equipment needs to be marked and stored in secure facilities when not in use. The planning budget should include cost estimates for installing security systems.

Insurance. All equipment needs to be listed on the district's master list of insured equipment.

Inventory. Particularly as the amount of equipment grows, the location of each piece of equipment in the district is important. A similar inventory of courseware should be prepared.

Maintenance and repair. Computers are not as delicate as they appear, but they do require periodic maintenance and they do break down. Maintenance and repair contracts usually are available from the computer distributer or from special repair facilities. As the amount of equipment increases, some consideration might be given to hiring a technician to take care of minor maintenance.

Recap

At the completion of this stage, you should have:

- ☐ established procedures for program coordination and implementation;
- ☐ developed a logistical support system; and
- ☐ developed a materials and equipment support system.

SUPPLEMENTARY READINGS

Section V

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VI. LOOKING AHEAD

At this point, you should have completed the planning and implementation cycle for the first time, in some areas quite thoroughly, in others, only superficially. For example, while the philosophy and mission statement and the general student competencies may be well specified, there may be additional work needed on instructional applications. Of course, staff development will never really be completed. Even as you begin implementing the plan, the ground will be shifting beneath your feet. New hardware and software will be available; new program ideas will surface in the literature or from the faculty. In short, the information that you used to develop the plan will be changing.

Because computer technology and our knowledge of it is changing so rapidly, the plan developed during the first cycle will likely be obsolete faster than the computer hardware it addresses. This is no reflection on the quality of the plan, but on the nature of planning in a rapidly changing environment. It is not merely or even primarily the advances in equipment that will require refinement and restructuring of plans; it is the rapid growth in our development as implementers of technology applications in schools. Plans will be obsolete to the degree that principals and teachers learn from their initial experiences and document needed improvements.

Repeating the planning cycle requires information about the implementation of the first plan and its impact on the curriculum objectives established. Thus, program monitoring and evaluation information is critical to the success of the next planning cycle.

All of this means that the planning cycle must continue. Perhaps the planning committee will become a standing one, with several new participants. However, let's look back at what activities we should have addressed.

Exhibit VI-1

This checklist can serve as a review of the planning process described in this manual. You may want to use it to monitor your progress or to explain your work to the school committee and other groups.

1. Preliminary Activities
   - ___ Form the planning committees
   - ___ Establish broad direction
   - ___ Conduct orientation activities
   - ___ Inventory current computer application
   - ___ Identify planning resource needs

2. Integrating Computers into the Curriculum
   - ___ Develop broad goal statements
   - ___ Develop student competency statements
   - ___ Set planning priorities
   - ___ Develop curriculum objectives
   - ___ Develop instructional strategies and applications

3. Staff Development
   - ___ Identify required staff competencies
   - ___ Determine actual staff competencies
   - ___ Establish staff development program

4. Hardware and Software Acquisition
   - ___ Establish selection criteria and process: software and hardware
   - ___ Prepare procurement specifications

5. Organization and Implementation
   - ___ Provide for program coordination and implementation
   - ___ Develop logistical support system
   - ___ Develop materials and equipment support system

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